REMARKS

Claims 1-14 were rejected under 35 U.S.C.§112, first paragraph as failing to comply with the written description requirement and under 35 U.S.C.§112, second paragraph for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention.

Reconsideration is requested in view of this Amendment.

Claims 1-14 have been cancelled and new claims 15-26 have been presented to point out the invention. New claim 15 points out a method for the reconstruction of holographic images in Digital Holography, comprising the following steps:

(a) The hologram of an investigated object is detected and recorded by a detection device (9) that is constituted by an integrated array of image detection elements (9), that spatially sample the hologram with a number N of pixels along the x-axis of the hologram plane, each having length Δx, and a number M of pixels along the y-axis of the hologram plane, each having length Δy, thus obtaining a rectangular array of a number $V_r = N_r \cdot M_r$ of values (51) proportional to light intensity values of the hologram, such a rectangular array being called a "digital hologram";

This step is based on the original description, page 1 lines 21-22, figures 1-2 ref. "2", page 7, 1-7, page 8 lines 14-17, page 10 lines 17-23. The fact that the values associated to pixels represent light intensity is implicit in the known method of Digital Holography. (This is shown in U.S. Patent No. 6,262,818, to Cuche et al., and U.S. Patent No. 6,246,495, to Yamaguchi)

(b) The hologram is reconstructed (13,15,16,17,18) in the observation plane, starting from the digital hologram to obtain a reconstructed image of the investigated object in the observation plane;

This step is based on the original specification, page 9 lines 10-13.

In addition, the method as defined in claim 1 is characterized in that the reconstruction of the hologram comprises the following sub-steps:

1 Adding new arbitrary values to the digital hologram, obtaining an expanded array comprised of $V_e = N_e \cdot M_e$ elements (50, 51), where $N_e = N_r + N'$ and $M_e = M_r + M'$ with N', M' being integer numbers, each arbitrary value being equal to the same constant value (50);

This is supported by figure 2, specification at page 12 lines 3-7, and figure 5: It is apparent that the number N'·M' has been added, as a symbol for the sake of clarifying the claim.

2 Applying the discrete Fresnel Transform on the expanded array of $V_e = N_e \cdot M_e$ values to obtain a final array of values proportional to light intensity values of the hologram, such final array being the reconstructed image of the investigated object;

This is supported by figure 2, specification at page 12 lines 3-7, page 9 lines 24-28, and original claim 1.

The total numbers N_e , M_e of added arbitrary values are inversely proportional to the respective pixel sizes $\Delta\xi$ and $\Delta\eta$ to be obtained in the observation plane for the reconstructed image (14), according to the relationships: $\Delta\xi = (\lambda d/N_e\Delta x)$ and $\Delta\eta = (\lambda d/M_e\Delta y)$, where λ is the wavelength of the wave beam striking the object of which the hologram is recorded, and d the distance between the detection device and the object of which the hologram is detected. This is supported by figure 2 and original claims 1 and7.

The other claims have the following support:

Claim 16: corresponds to original claim 2;

Claim 17: corresponds to original claim 3 + the feature "to obtain an extended array in which digital hologram is embedded", as disclosed in figure 5 of the drawings and page 12 lines 29-33 of the specification.

Claim 18: corresponds to original claim 4 + the feature "i.e. said N',M' values are arranged symmetrically around said digital hologram", as derivable from figure 5 of the drawings and page 12 lines 29-33;

Claim 19: corresponds to original claim 5 + the feature "i.e. said N',M' values are arranged non-symmetrically around said digital hologram", as derivable from figure 5 of the drawings and page 12 lines 29-33;

Claim 20: corresponds to original claim 9, where the symbols N'·M' for the added number of values has been introduced;

Claim 21: corresponds to original claim 10;

Claim 22: corresponds to original claim 8;

Claim 23: corresponds to original claim 11;

Claim 24: corresponds to original claim 12;

Claim 25: corresponds to original claim 13;

Claim 26: corresponds to original claim 14, where the feature "comprising an integrated array of image detection devices (9)" has been added, see page 1 lines 21-22.

It is believed that the newly presented claims avoid all of the issues that were raised under 35 U.S.C.§112, first and second paragraphs and favorable consideration is requested.

Claims 1-4 were rejected under 35 U.S.C.§103(a) as being unpatentable over Cuche et al. (Cuche).

Reconsideration is requested.

With respect to the claimed invention as pointed out in new claim 15, Cuche fails to teach that, prior to applying the Fresnel transform, the digitised hologram is embedded into an array having a larger number of elements (values associated to fictitious pixels). In addition, Cuche fails to teach that the number of added values is inversely proportional to the desired pixel size to be obtained for the reconstructed image, according to the claimed relationships. The technical effect of these differences between the claimed invention and the Cuche was pointed out in the original description on page 12 lines 22-27 and on page 14 lines 20-31, i.e. the possibility to correct the resolution loss due to the Fresnel transform

and therefore to change image size, allowing the comparison of images reconstructed at different distances from the observation plane.

The objective problem underlying the invention is thus to modify the method according to Cuche at al in order to achieve these technical effects.

This problem has now been solved according to the method as defined in new claim 15, i.e. by its characterizing features.

This solution is not obvious for the following reasons:

1. In Cuche the reconstruction is made only for eliminating the phase aberration (see col. 3 lines 6-8), the controlled resolution's change itself being not sought. There a digital phase mask is computed (see claim step k)) and several parameters have to be adjusted (claim step o)). This is not provided in the present invention as defined by the newly presented claims.

As stated in the original description of the present invention, page 4 lines 6-18:

> "T. M. Kreis et al. (Kreis) in the article 'Methods of Digital Holography: a comparison', Proceedings of the SPIE, SPIE, Bellingham, VA, US, vol.3098, 1997, pages 224-233, ISSN: 0277-786X, teaches the embedding of a digitised hologram into an array having a larger number of pixels in the specific context of the convolution approach, in order to vary the size of the reconstructed images.

In the Kreis article, moreover, it is concluded that the Fresnel approach cannot be applied if reconstruction in different depths are to be compared, and inversely, the convolution approach is not much suited if the whole possible field of view for opaque or transparent objects has to be reconstructed.

A general method of varying the resolution of the reconstructed image is not provided in the prior art.

Since Kreis knew the Fresnel approach in reconstruction of holographic images, and proposed to embed the digitised hologram into an array having a larger number of pixels only in the Convolution approach, T. M. Kreis et al. teaches away from the solution of the objective technical problem, i.e. using the Fresnel transform + embedded array. This is persuasive evidence that the combination of Fresnel + embedded array would not have

been obvious to a skilled person in the art and thus is not made obvious by Cuche.

The functional dependence of the number of added fictitious points is not addressed in neither in Cuche nor in Kreis . This functional dependence is in fact an essential feature implied in the Fresnel Transform as used in the claimed method. Therefore, the functional combination of the Fresnel approach and the feature of embedding the digitised hologram array is new and unobvious. For these reasons, it is requested that this ground of rejection be withdrawn.

An early and favourable action is earnestly solicited.

Respectfully submitted,

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